

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
26 July 2001 (26.07.2001)

PCT

(10) International Publication Number
WO 01/54354 A1

(51) International Patent Classification⁷: **H04L 12/28**

(21) International Application Number: **PCT/US01/02205**

(22) International Filing Date: **22 January 2001 (22.01.2001)**

(25) Filing Language: **English**

(26) Publication Language: **English**

(30) Priority Data:
60/176,928 20 January 2000 (20.01.2000) US

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(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

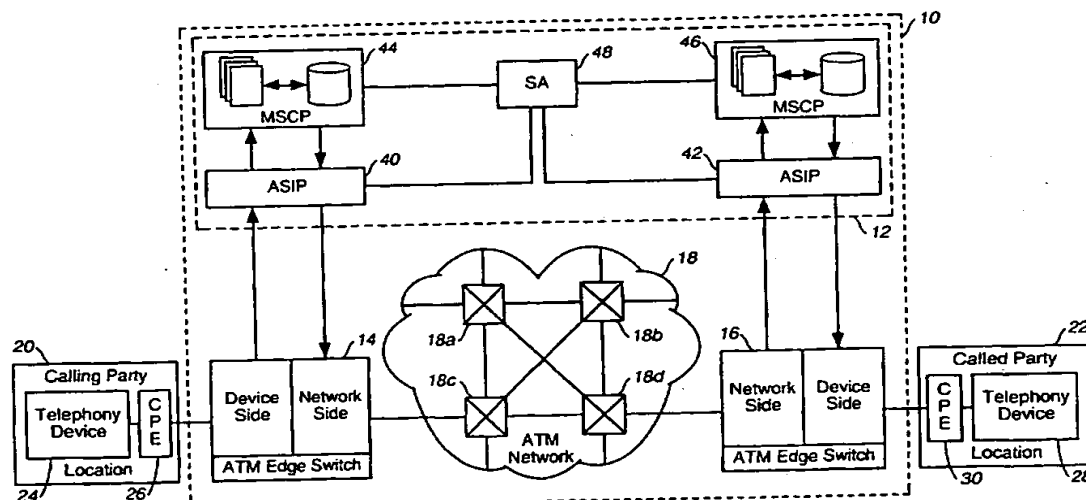
(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **INTELLIGENT NETWORK AND METHOD FOR PROVIDING VOICE TELEPHONY OVER ATM AND POINT-TO-MULTIPOINT CONNECTIVITY**



(57) Abstract: An illustrative intelligent network (12) and method for providing voice telephony over ATM and point-to-multipoint connectivity are provided that can provide significant advantages. A method for providing a point-to-multipoint service to control point-to-multipoint connections using an intelligent network (12) and a switched virtual circuit over an ATM network (18) includes a receiving a request from a calling party (20) to establish a point-to-multipoint connection, determining if the calling party (20) is authorized to make point-to-multipoint connections, rejecting the request if the calling party (20) is not authorized to establish point-to-multipoint connections, analyzing the request to determine if the bandwidth requested for the point-to-multipoint connection is within authorized bandwidth limits, and rejecting the request if the bandwidth is not within authorized bandwidth limits. An intelligent network (12) for providing VToA and point-to-multipoint connectivity is also provided.

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**INTELLIGENT NETWORK AND METHOD FOR PROVIDING
VOICE TELEPHONY OVER ATM AND
POINT-TO-MULTIPOINT CONNECTIVITY**

5 This invention relates in general to the field of data networks, telecommunications and more particularly to an intelligent network and method for providing voice telephony over Asynchronous Transfer Mode ("ATM") and point-to-multipoint connectivity.

10 The need for both voice telephony services as well as data services is common. Traditionally, this may only be achieved through the use of separate services. For example, dedicated voice telephony services and dedicated data services are provided over separate and distinct
15 networks. This is a significant disadvantage because of the high expense of maintaining and paying for such separate and distinct services, not to mention the inconvenience and inefficiency introduced because voice and data services are not integrated.

20 Packet-switched telecommunications networks may be based on any of a variety of technologies and protocols such as, for example, Asynchronous Transfer Mode ("ATM"), MultiProtocol Label Switching ("MPLS"), Internet Protocol ("IP"), Frame Relay ("FR"), and X.25. Packet-switched
25 telecommunications networks have data packets, cells, frames or blocks (hereinafter "packets" or "cells") that are either of fixed length or variable length. Although originally designed to transmit data, as opposed to voice or voice encoded data, packet-switched telecommunications
30 networks may be used for voice communications. Some of the packet-switched technologies that may be used for voice communications include, without limitation, Voice Telephony over ATM ("VToA"), Voice over Frame-Relay ("VoFR"), Voice over Digital Subscriber Line ("VoDSL"),
35 and Voice over IP ("VoIP").

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Focusing on VToA when compared to voice communications or voice telephony provided over traditional circuit-dedicated or circuit-switching telecommunications networks, the use of VToA, unfortunately, presents significant problems and disadvantages, especially in view of the fact that the needs of both data communications and voice communications must be met over the same network. For example, VToA does not provide advanced telephony services and features that are commonly found in traditional circuit-dedicated telecommunications networks. Similarly, advanced signaling, also commonly found in traditional circuit-dedicated telecommunications networks, is not available for VToA in the same manner that circuit-dedicated or circuit-switching telecommunications networks.

To setup and establish a Switched Virtual Circuit ("SVC") to support VToA between a calling party and a called party, various signaling or ATM messages are used within the ATM network. This may be achieved using ATM setup and connect messages. Once ATM signaling has established an SVC, a data connection is defined and data, such as voice encoded data, may be communicated. Voice encoded data may continue to be communicated until one end of the SVC issues a release message (or any similar message that causes a disconnection). At such time, the SVC is released and voice communications ceases. Examples of traditional ATM signaling used to setup and release point-to-point and point-to-multipoint SVCs for telephony applications are illustrated in the book entitled *Hands-On ATM* by David E. McDysan and Darren L. Spohn, which is incorporated herein for all purposes.

In a traditional telecommunications or voice network, signaling can be in-band or out-of-band. Signaling may be used to setup and establish voice

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circuits, to provide Intelligent Network ("IN") or Advanced Intelligent Network ("AIN") services and features, and to disconnect voice circuits. In an ATM network, where an SVC is established to support VTOA, signaling is achieved through the use of ATM messages, such as those used to setup and disconnect SVCs. Unfortunately, such ATM signaling does not support IN or AIN to provide the advanced telephony services and features commonly found in traditional voice telecommunications networks. This significantly reduces the attractiveness of VTOA as compared to traditional voice telecommunications networks or even some other data or packet networks capable of providing voice or telephony communications services.

More particularly, a serious problem and drawback of existing VTOA is the difficulty or inability to institute advanced calling features on an ATM network-wide basis. Unfortunately, many customary and advanced voice telephony services, which are often available through traditional telecommunications networks designed to transport and support voice telephony, such as circuit-dedicated telecommunications networks, are not available or easily achieved or implemented with VTOA. For example, the capability to block calls from one or more locations in a corporation to other locations or areas, such as a specified country or countries, is a valuable service or option that is available in traditional voice telecommunications networks. To implement such a service or feature in a traditional VTOA would require that blocking information be provided in various systems and gateways and updated as needed. This is inefficient, cumbersome and expensive to carry out. As is illustrated, this type of a service is problematic to implement in traditional VTOA networks and systems. Various other valuable telecommunications services and

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features, which may be available in traditional telecommunications networks, suffer from the same significant disadvantage illustrated above.

5 In addition to the significant limitations in ATM signaling to support advanced or intelligent network telephony, the administration and maintenance of VToA systems and processes is extremely burdensome and expensive. For example, numerous private and public
10 phone numbers, which change frequently, have to be updated and maintained in various systems and gateways. As moves, adds, changes, and deletions occur, each VToA gateway must be updated with the relevant changes. This is a critical task that is onerous and expensive to perform and fraught with potential errors.

15 Another serious drawback of traditional ATM network signaling is the lack of control regarding the establishment of point-to-multipoint connections. A point-to-multipoint connection may be defined as a unidirectional connection from a root node to multiple
20 leaf nodes. Leaf nodes may be added or dropped as needed, without any automatic control or restriction on the bandwidth used or the number of leaf connections involved in such connections. As a result, point-to-multipoint connections on ATM networks are problematic
25 and present a serious threat to the stability and performance of ATM networks.

30 From the foregoing it may be appreciated that a need has arisen for an intelligent network and method for providing VToA and point-to-multipoint control and connectivity that provides intelligent network signaling to support advanced telephony services and features for VToA and that support point-to-multipoint control, while
35 still allowing the benefits of integrating voice and data communications on the same ATM network. In accordance with the present invention, an intelligent network and

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method for providing VToA and point-to-multipoint connectivity are provided that substantially eliminate one or more of the disadvantages and problems outlined above.

5 According to one aspect of the present invention, an intelligent network for use with an ATM network to set up an ATM switched virtual circuit to provide VToA services and point-to-multipoint connectivity is provided. The intelligent network includes a multi-service control
10 point, an ATM signaling intercept processor, and a service administration. The multi-service control point receives an input extracted from an input ATM setup message that includes a called party phone number value, a VToA designator, and a request to establish a point-to-
15 multi-point connection. The multi-service control point enforces policies regarding the establishment of point-to-multipoint connections, and generates an output in response for use in generating an output ATM setup message. The ATM signaling intercept processor
20 intercepts the input ATM setup message from an ingress ATM edge switch of the ATM network, extracts the input from the input ATM setup message, communicates the input to the multi-service control point, receives the output generated by the multi-service control point, generates
25 the output ATM setup message using the output, and communicates the output ATM setup message to the ingress ATM edge switch of the ATM network. The service administration provisions the multi-service control point and the ATM signaling intercept processor.

30 According to another aspect of the present invention, a method for providing a point-to-multipoint service to control point-to-multipoint connections using an intelligent network and a switched virtual circuit over an ATM network is provided. The method includes
35 receiving a request from a calling party to establish a

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point-to-multipoint connection, determining if the calling party is authorized to make point-to-multipoint connections, rejecting the request if the calling party is not authorized to establish point-to-multipoint connections, analyzing the request to determine if the bandwidth requested for the point-to-multipoint connection is within authorized bandwidth limits, and rejecting the request if the bandwidth requested is not within authorized bandwidth limits. An intelligent network for providing VToA and point-to-multipoint connectivity is also provided.

The present invention provides a profusion of technical advantages that include the capability to efficiently and effectively provide advanced telephony services and functions, such as those related to point-to-multipoint connectivity and control and those related to VToA, through an intelligent network.

The present invention provides the significant technical advantage of allowing point-to-multipoint connections to be conveniently and efficiently managed, while minimizing the potential dangers that point-to-multipoint connections pose to ATM networks. In particular, point-to-multipoint connections are provided on an ATM network with a mechanism to easily manage potential negative bandwidth effects from point-to-multipoint connections. Users receive a more reliable ATM network and bandwidth allocation among users is determined with more certainty.

Yet another technical advantage of the present invention concerns the capability to provide a mechanism to control and provision the establishment and use of point-to-multipoint connections on an ATM network. This mechanism allows the size of a point-to-multipoint connection on an ATM network to be controlled through a limitation on the number of leaf nodes, while not

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interfering or affecting the performance of the existing point-to-multipoint connection. This mechanism also serves to protect the network from deliberate and accidental acts that may harm or degrade the performance of the network.

Another technical advantage of the present invention includes the capability to utilize an ATM network to provide advanced telephony functions, while efficiently using ATM bandwidth by setting up SVCs to handle phone calls and releasing this bandwidth when the phone call has ended. This results in efficient utilization of ATM bandwidth and may save capital costs by reducing the amount of bandwidth needed.

Yet another technical advantage of the present invention includes the capability to control ATM telephony or voice routing tables in a central location and in the intelligent network layer, as opposed to the prior technique, defined by the various ATM standards bodies, to control ATM telephony at the end points. This significantly reduces overall costs to operate a telecommunications network to support VToA, and significantly reduces the opportunity for erroneous information entering the network. This advantage is achieved by separating the ATM intelligence from the ATM switching.

Other technical advantages are readily apparent to one skilled in the art from the following figures, description, and claims.

For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following brief description, taken in connection with the accompanying drawings and detailed description, wherein like reference numerals represent like parts, in which:

FIGURE 1 is a diagram that illustrates a

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telecommunications network for providing VToA services using an ATM switched virtual circuit according to an embodiment of the present invention;

5 FIGURE 2 is a line diagram that illustrates the signaling and call flow performed by the intelligent network for a VToA call, including the setup, connect, and release portions, according to an embodiment of the present invention;

10 FIGURE 3 is a block diagram that illustrates an intelligent network used at the ingress side of an ATM network for providing VToA services using an ATM switched virtual circuit;

15 FIGURE 4 is a block diagram that illustrates the intelligent network used at the egress side of the ATM network for providing VToA services using an ATM switched virtual circuit;

20 FIGURE 5 is a diagram, similar to FIGURE 1, that illustrates a telecommunications network for providing point-to-multipoint services to control the setup of a point-to-multipoint connection, according to an embodiment of the present invention;

25 FIGURE 6 is a line diagram, similar to FIGURE 2, that illustrates the signaling and call flow performed by the intelligent network for controlling and providing point-to-multipoint connectivity, according to an embodiment of the present invention; and

30 FIGURE 7 is a flowchart that illustrates a method for providing a point-to-multipoint service to control point-to-multipoint connections using an intelligent network and a switched virtual circuit over an ATM network, according to another aspect of the present invention.

35 It should be understood at the outset that although an exemplary implementation of the present invention is illustrated below, the present invention may be

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implemented using any number of techniques, whether currently known or in existence. The present invention should in no way be limited to the exemplary implementations, drawings, and techniques illustrated below, including the exemplary design and implementation illustrated and described herein.

FIGURE 1 is a diagram that illustrates a telecommunications network 10, which also may be referred to as an intelligent ATM network or as a Smart Bandwidth on Command ("SBoC") network, for providing Voice Telephony over ATM ("VToA") services using an ATM Switched Virtual Circuit ("SVC") according to an embodiment of the present invention. The description below in connection with FIGURES 1-4 provides a discussion of the operation of the telecommunications network 10 for a point-to-point VToA connection, which assists with understanding the setup of a point-to-multipoint connection, including either a point-to-multipoint data, video or VToA connection. This will allow for a better understanding of the point-to-multipoint aspect of the present invention, which is described more fully in connection with the description accompanying the FIGURES 5, 6 and 7.

The telecommunications network 10 includes an intelligent network 12, which also may be referred to as an intelligent network layer, in communication with an ATM edge switch 14 and an ATM edge switch 16 of an ATM network 18. A calling party location 20 is illustrated in communication with the ATM edge switch 14, and a called party location 22 is shown in communication with the ATM edge switch 16.

The intelligent network 12 is operable to intercept and process ATM signaling messages provided to the ATM edge switch 14 and the ATM edge switch 16. This architecture allows the intelligent network 12 to provide

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various telephony features and services, including advanced telephony features and services, to VToA provided over an ATM network, such as the ATM network 18, through an SVC.

5 It should be noted that the ATM edge switch 14 and the ATM edge switch 16 may be considered to be part of the ATM network 18. Of course, the ATM network 18 may include any of a variety of ATM switches and/or ATM network elements or devices and may geographically span
10 or cover virtually any region. The ATM switches of the ATM network 18, including the ATM edge switch 14 and the ATM edge switch 16, may be provided by any of a number of ATM switch manufacturers, such as, for example, NEWBRIDGE and ALCATEL. Of course, multiple connections can be
15 provided to the ATM network 18 through any of a variety of edge switches, such as at the ATM edge switch 14. In order to simplify the illustration of the present invention, including the illustration of setting up a VToA call originating from a calling party, only two
20 connections to the ATM network 18 are illustrated in FIGURE 1 and include the calling party location 20 and the called party location 22.

The calling party location 20 and the called party location 22 may include any of a variety of end-user
25 devices and Customer Premises Equipment ("CPE"). For example, the calling party location 20, which could be referred to as an ingress location since this is the calling location, includes a telephony device 24 and a CPE 26. Similarly, the called party location 22 is
30 illustrated with a telephony device 28 and a CPE 30.

Of course, any of a number of arrangements may be provided at the calling party location 20 and the called party location 22. In one embodiment, these locations may also include Data Communications Equipment ("DCE") to
35 support traditional ATM data communications. As is

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apparent, the capability to communicate both data and voice over the same ATM network provides significant advantages and conveniences that normally result in substantial savings. This arrangement in combination with the present invention allows both VToA calls, with intelligent network features and services provided or controlled by the intelligent network 12, and ATM data transfers to be supported using the same ATM network, such as the ATM network 18. For example, a business enterprise that has multiple locations may significantly benefit by providing voice communications, with intelligent networking features, using VToA and data communications all through the same ATM network.

In one embodiment, the telephony device 24 and the telephony device 28 may be provided as a telephone, a personal computer, a computer network, answering machine, video conferencing equipment, or any of a variety of other devices operable to support or provide telephony functionality. The CPE 26 and the CPE 30 may be implemented using any of a number of devices. For example, and without limitation, the CPE 26 and the CPE 30 may be implemented as a router, a PBX with ATM signaling capability, an enterprise gateway, or a network gateway. The CPE 26 and the CPE 30 may be implemented, in one embodiment, using a CPE device provided by ACCELERATED NETWORKS.

The communications link between the ATM edge switch and the calling party or called party location may be provided using any number of available links, such as dedicated links or leased lines. According to an aspect of the present invention, whenever a customer location desires to set up or establish an SVC to support VToA, a signaling ATM message, such as an ATM setup message, is provided from the customer location to the associated ATM edge switch of the ATM network 18. For example, if the

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calling party location 20 desires to establish an SVC through the ATM network 18, an ATM setup message may be sent from the calling party location 20 to the ATM edge switch 14. This ATM setup message may be used to designate that this SVC is being setup or established to provide VToA. In one embodiment, an ATM setup message is sent from the calling party location 20 to the ATM edge switch 14 using a predefined or predetermined protocol such that a designated value, which may be referred to as a VToA designator, is included in the content or payload of the ATM setup message to indicate that this SVC is being set up or established to support VToA.

In one embodiment, the telephony device 24 is provided as a telephone or personal computer with telephony software, and the CPE 26 is provided as an enterprise gateway that is provisioned with a special ATM address to identify the CPE 26 as an ATM device. An ATM setup message may be generated by a calling party by using the telephony device 24 to enter a phone number, which may be referred to as a called party phone number value. The CPE 26 generates the ATM setup message, which may be referred to as an input ATM setup message, in response to initiate an SVC for VToA by saving various values in the content of the ATM setup message.

The content may be stored in an ATM setup message using various designated areas, which may be referred to as fields, addresses or parameters. The content that is stored in each such parameter may be referred to as a value. An example of some of the parameters that may be present in an ATM setup message is provided in the following table:

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ATM SETUP MESSAGE PARAMETERS	
Called Party Number	
Called Party Subaddress	
Calling Party Number	
Calling Party Subaddress	

5
10 In a preferred embodiment of the present invention, the ATM address of the CPE 26, which may be referred to as the ATM address of the calling party CPE, is stored in the ATM setup message as the calling party number parameter, the telephone number associated with the telephony device 24, which may be referred to as the
15 calling party phone number value, is stored in the ATM setup message as the calling party subaddress parameter, a special or designated number or address, which may be referred to as the VToA designator, is stored in the called party number of the ATM setup message, and the
20 dialed or called telephone number, which may be referred to as the called party phone number value, is stored in the called party subaddress of the ATM setup message.

25 This input ATM setup message is then provided to the ATM network 18 at the ATM edge switch 14. In essence, this ATM setup message instructs the ATM network 18 to setup an SVC between the ATM address of the CPE 26 and the special or designated ATM address that is provided as the called party number of the ATM setup message. This special or designated ATM address or number may also be
30 referred to as a VToA designator. This is a predetermined or predefined number which will be used by the intelligent network 12 to indicate that this setup message request for an SVC is to provide VToA and hence the advance telephony services or features of the present
35 invention should be applied by the intelligent network

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12.

The input ATM setup message is received at the ATM edge switch 14. The ATM edge switch 14, just like the ATM edge switch 16, may be thought of as divided into two portions, a device side portion and a network side portion. The device side is the side where a customer or client interfaces, generally through a CPE, with the ATM network 18. Signaling messages received at the device side of the ATM switch 14 from the CPE 26 are intercepted by the intelligent network 12. The intelligent network 12, which will be described more fully below in connection with FIGURE 1 and FIGURES 3 and 4, receives the input ATM setup message generated by the CPE 26 and analyzes its contents. From this analysis, the presence of the VToA designator, which in one embodiment may be stored in the called party number parameter of the ATM setup message, indicates that this input ATM setup message is a request to setup an SVC for VToA.

Once it is determined that the signaling message is a request to setup or establish an SVC for VToA, the intelligent network 12 will, preferably, perform as much processing as possible on the ATM setup message at the ingress ATM edge switch. Before discussing some of the various intelligent network services or features that may be provided by the present invention, the processing of the input ATM setup message is discussed. In one embodiment, the intelligent network 12 locates the called party phone number value and performs a table search or "look-up" to determine a corresponding ATM address, such as the ATM address for a destination CPE or device, such as a termination gateway, an enterprise gateway or a network gateway. This ATM address may be referred to as the ATM address of the called party CPE. In a preferred embodiment, the called party phone number value is retrieved from the called party subaddress parameter to

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perform the necessary functions to find the associated destination ATM address. Once located, this destination ATM address may be provided so that a modified or output ATM setup message may be generated to establish an SVC to support VToA from the CPE 26 to the destination ATM device. In a preferred embodiment, the calling party phone number value is stored in the calling party subaddress parameter of the input ATM setup message, and the ATM address of the calling party CPE or device is stored in the calling party number parameter of the input ATM setup message.

When a VToA call originates from the calling party location 20 and terminates at the called party location 22, the ATM edge switch 14 may be referred to as the ingress ATM switch while the ATM edge switch 16 may be referred to as the egress ATM edge switch. Generally, each such ATM edge switch may function as either an ingress or an egress ATM edge switch.

The output ATM setup message is transmitted from the intelligent network 12 to the network side of the ATM edge switch 14 where it is sent to the ATM network 18. The output ATM setup message is transmitted through the ATM network until it arrives at the network side of the ATM edge switch 16. The intelligent network 12 intercepts and processes this ATM message and, generally, will provide the ATM message back to the device side of the ATM edge switch 16 at the appropriate port so that it will be communicated to the CPE 30 of the called party location 22. If the intelligent network 12 modifies or changes the output ATM setup message, the resulting ATM message may be referred to as a destination or gateway ATM setup message.

A preferred embodiment of an implementation of the intelligent network 12 is provided next. The intelligent network 12, as shown in FIGURE 1, includes an ATM

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5 signaling intercept processor ("ASIP") 40, which is associated with the ATM edge switch 14 that is shown serving as an ingress ATM edge switch, an ASIP 42, which is associated with the ATM edge switch 16 that is shown serving as an egress switch, a multi-service control point ("MSCP") 44 in communication with the ASIP 40, an MSCP 46 in communication with the ASIP 42, and a service administration 48. The service administration 48, in the embodiment shown in FIGURE 1, is operable to provision the ASIP 40, the MSCP 44, the ASIP 42, and the MSCP 46. In provisioning these elements of the intelligent network 12, the service administration 48 will, preferably, provide user interfaces to each such element. In a preferred embodiment, the service administration 48 also maintains a database of record, which may be the same as or similar to the database shown in the MSCP 44 and the MSCP 46.

20 The ASIP 40 and the ASIP 42 will generally be associated with a designated ATM edge switch, such as the ATM edge switch 14 and the ATM edge switch 16. The MSCPs, such as the MSCP 44 and the MSCP 46, may interface or work in conjunction with one or more ASIPs. In an alternative embodiment, one MSCP interfaces and works with all ASIPs of the intelligent network 12. All of the MSCPs of the intelligent network 12 may provide the same or essentially the same functionality.

25 The ASIP 40 and the ASIP 42, generally, function to intercept ATM signaling messages, such as an ATM setup message, an ATM connect message, and an ATM release message. The ASIP 40 and the ASIP 42 intercept and process ATM signaling messages from the associated switch whether the signaling messages are provided from the device side or from the network side of the associated ATM edge switch. It should be noted that the ASIP 40 and the ASIP 42 are both capable of or operable to receive

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signaling messages provided through their associated ATM edge switch in either direction. For example, although the call setup illustrated in FIGURE 1 illustrates a VToA call that originates at the calling party location 20 and terminates at the called party location 22, the ASIP 40 and the ASIP 42 perform their functions when the ATM signaling messages are traveling in the opposite direction, such as if the called party location 22 originates a VToA call through an SVC to the calling party location 20. Once the ATM signaling message, such as the input ATM setup message, is intercepted, an input is generated by the ASIP and the input is provided to the associated MSCP, such as the MSCP 44 and the MSCP 46.

The MSCP 44 and the MSCP 46 both contain various applications that can provide intelligent network and even advanced intelligent network VToA services and features. The applications will preferably be provided as software applications that provide the desired logic and algorithms to achieve the desired intelligent network service or feature. In performing these various services and features, the MSCPs must access various information that may include, for example, ATM addresses, associated telephone numbers, customer profiles, user profiles, and any of a variety of other needed information to support or provide the desired service and feature.

As a result of the processing performed by the MSCP 44 and the MSCP 46, an output is generated. The output is then provided back down, as represented by the arrows extending from the MSCPs to their associated ASIPs, so that the ASIP 40 and the ASIP 42 may assemble the output to generate a resulting ATM message. The ASIP, in a preferred embodiment, also provides call modeling functionality that allows multiple calls to be modeled.

To illustrate the operation of the intelligent network 12 to provide intelligent network functionality

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to the telecommunications network 10 and the ATM network 18, the establishment of an SVC for VToA is illustrated next. Assuming that the calling party location 20 initiates the establishment or setup of an ATM SVC for VToA with the telephony device 28 of the called party location 22, the CPE 26 of the calling party location 20 responds to the request by the telephony device 24 to setup a phone call. The CPE 26 generates an input ATM setup message and provides this input ATM setup message to the ATM edge switch 14. The ATM edge switch 14 may be thought of as having a device side portion and a network side portion, just like the ATM edge switch 16. The input ATM setup message is received at the device side of the ATM edge switch 14 and is intercepted by the ASIP 40.

The ASIP 40 processes the input ATM setup message and, using one or more of the various values that may be stored within or in association with the input ATM setup message, generates an input. The input is then communicated or provided to the MSCP 44. The MSCP 44 may provide any number of telephony services and features. The MSCP 44, however, must analyze the input to determine if the input ATM setup message is a request for an SVC for VToA. In a preferred embodiment, a predefined or predetermined value is stored within the called party number parameter of the input ATM setup message. The value provided within this called party number parameter of the input ATM setup message is analyzed to determine if the input ATM setup message is requesting an SVC for VToA. In one embodiment, the value stored within the called party number parameter of the input ATM setup message may be referred to as a VToA designator, i.e., designating that the input ATM setup message is a request for an SVC for VToA. It should be understood, however, that any of a variety of ATM setup messages parameters may be used to provide this functionality. The CPE 26,

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which originally generated the input ATM setup message, will store the appropriate VToA designator value within the appropriate parameter, such as the called party number parameter, when generating the input ATM setup message so that the appropriate MSCP associated with the ingress ATM edge switch will recognize the input ATM setup message as one requesting an SVC for VToA.

If the VToA designator is not found, the MSCP 44 will provide an output to the ASIP 40 and the ATM setup message will continue as if a request is being made to establish or setup an SVC for a data transfer. If the VToA designator is found, additional service and feature processing may proceed. In order for the SVC for VToA to be established, a called party phone number value, which will be included as part of the input from the ASIP 40, will need to be correlated by the MSCP 44 with a corresponding value that is equal to the ATM address of the called party CPE, which is in this case is the CPE 30. If the called party phone number value is not found, the call may fail or be rejected. The ATM address of the called party CPE and the called party phone number value, along with any other values generated as a result of the processing that may have occurred through any of a variety of services and features that may be provided by the MSCP 44, results in the MSCP 44 generating an output. The output is received and used by the ASIP 40 to generate or assemble an output ATM setup message.

The output ATM setup message may then be provided to the network side of the ATM edge switch 14 where it is then routed through the ATM network 18 using traditional or available ATM protocols until the output ATM setup message is received at the network side of the ATM edge switch 16. Of course, the ATM network 18 may include any of a variety or any number of ATM switches, such as the ATM switches 18a, 18b, 18c, and 18d. It should also be

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noted that any number of additional ATM edge switches may be connected to the ATM network 18 through virtually any available ATM switch or ATM network element.

5 The output ATM setup message is received at the network side of the ATM edge switch 16 where the ASIP 42 intercepts the signaling message and generates an input. The input is provided from the ASIP 42 to the MSCP 46. The MSCP 46, similar to the MSCP 44, analyzes the input to determine what, if any, processing is needed. In this
10 case, the MSCP 46 finds the ATM address of the called party CPE, which in this case is the CPE 30, in the input and provides appropriate routing information and generates a corresponding output of the MSCP 46. Of course, various other processing may also occur,
15 depending on the particular feature or service.

 The ASIP 42 receives the output from the MSCP 46 and generates or assembles another setup message. In one embodiment, the resulting ATM setup message may be referred to as a destination or gateway ATM setup message
20 since it will ultimately be provided to the CPE 30, which may be implemented as an enterprise gateway, a network gateway or any of a variety of telephony access devices. If the output ATM setup message is not changed by the output from the MSCP 46, the resulting ATM setup message
25 may still be referred to as the output ATM setup message and it is provided to the device side of the ATM edge switch 16, just like any destination or gateway setup message, where it is then provided to the CPE 30.

 At the CPE 30, the appropriate telephony device, in
30 this case telephony device 28, is contacted so that a call may be established or setup. In response, the CPE 30 may generate an ATM connection message or any other ATM signaling message which is available and would be known of ordinary skill in the art. For example an ATM
35 connection message and an ATM release message may be

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generated during this VToA call.

FIGURE 2 is a line diagram 100 that illustrates the signaling and call flow performed by the intelligent network for a VToA call, including the setup, connect, and release portions of the VToA call, according to an embodiment of the present invention. The VToA call is achieved through the use of an ingress device 102, an ingress ATM edge switch 104, an ingress ASIP 106, an ingress MSCP 108, an ATM network 110, an egress ATM edge switch 112, an egress ASIP 114, an egress MSCP 116, and an egress device 118. Starting in the upper lefthand portion of FIGURE 2, an input ATM setup message is generated and provided from the ingress device 102 to the ingress ATM edge switch 104.

The ingress device 102 may be any of a variety of devices such as the CPE 26 of FIGURE 1, a router, a PBX, a telephony access device, or a gateway, such as an enterprise gateway or a network gateway to provide access to the Public Switched Telephone Network ("PSTN"). Generally, the ingress device 102 must simply have the capability to generate an input ATM setup message that includes a VToA designator stored in the called party number parameter of the input ATM setup message (or other location or parameter depending on the intelligent network design), and a called party phone number value stored in the called party subaddress parameter of the input ATM setup message. In other embodiments, the input ATM setup message may also contain the value of the ATM address of the calling party CPE and the calling party phone number value. In such a case, these values are preferably stored in the calling party number parameter and the calling party subaddress parameter, respectively, of the input ATM setup message. Line 120 represents the communication of the input ATM setup message from the ingress device 102 to the ingress ATM edge switch 104.

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It should be noted that the line diagram 100 illustrates only the basic signaling and call flow of a VToA call. Other signals or messages, which would be understood by one of ordinary skill in the art and normally provided automatically as part of one or more ATM specifications, may include various acknowledgment signals or messages, such as connect acknowledge, a call proceeding message, and a release complete message.

The ingress ATM edge switch 104 receives the input ATM setup message and communicates it to the ingress ASIP 106 as represented by a line 122. The ingress ASIP 106 provides various values and addresses contained within various parameters of the input ATM setup message and provides those values to the ingress MSCP 108 as shown in a line 124. For example, the ingress ASIP 106 may provide the VToA designator, which may be stored in the called party number parameter of the input ATM setup message, and the called party phone number value, which may be stored in the called party subaddress parameter of the input ATM setup message, to the ingress MSCP 108. The VToA designator is used in the present invention to indicate that a setup message is requesting to set up an SVC for VToA.

After the ingress MSCP 108 confirms, by analyzing the value of the VToA designator, that an SVC for VToA is requested, the ingress MSCP 108 may perform any of a variety of advanced telephony functions to provide VToA services and features as desired or requested. If a VToA designator is not found by the MSCP 108 during setup, an ATM data call may be assumed. The ingress MSCP 108 may provide any of a variety of advanced telephony functions to provide VToA services and features. Example of some of these services and features include Default Calling Party Number Handling ("DCH"), Source Address Validation ("SAV"), Customer Port Maximum Call Attempt Rate Limit

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("CMR"), Closed User Group ("CUG"), Destination Address Screening ("DAS"), Source Address Screening ("SAS"), Customer Port Maximum Burst Size Limit ("CMDS"), Customer Port Aggregate Bandwidth Limit ("CBW"), Customer Port Maximum Concurrent Calls in Progress Limit ("CMC"), Private Address Translation ("PAT"), Customer Port Service Class Selection ("CSCS"), and Point-to-Multipoint, Root-Initiated Connections ("P2MR"). Preferably, most of the intelligent network features and processing are performed at the ingress MSCP 108. In some cases, such as, for example, PAT, additional intelligent networking service or feature processing must be performed at other locations, such as the egress MSCP 116.

A brief summary of the calling services and features mentioned above is provided. DCH provides logic to handle input ATM setup messages in which a calling party phone number value is not provided. In such a case, the DCH feature may substitute a default calling party phone number value. SAV determines whether a user is requesting a call through an authorized or proper port. VToA privileges may be given on a per port basis, and the SAV feature may insure that only authorized users are allowed to access the ATM network through particular network ports, such as a physical port or a Customer Logic Port ("CLP"). CMR may be used to verify that the number of access attempts at a CLP does not exceed a provisioned or predetermined rate.

The CUG feature allows various users of an enterprise or customer to be partitioned into defined user groups. This allows various policies or privileges to be enforced on a group basis. A basic feature of CUG is to provide the capability to restrict calls to other users outside of the CUG or within certain other closed user groups. The DAS and SAS services or features

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provide call-screening lists that allow either the originating party or the terminating party to define the addresses to which calls can be made or from which calls can be received, respectively. In one embodiment, two types of call-screening lists may be supported for each user or subscriber that include a group list and a user list. This allows these services or features to be provided either on a group basis, an individual user basis, or both. The CMBS and CBW services or features provide a mechanism in which burst-size and bandwidth requests may be limited. This may prevent a few users from allocating large amounts of bandwidth and ATM network capability at the expense of other users. Similarly, the CMC feature limits the number of connections through a particular port.

The PAT service provides the significant advantage of allowing a customer to keep its own ATM numbering or addressing scheme. PAT is an example of a feature that requires ATM intelligent network processing, according to an embodiment of the present invention, at both the ingress ATM edge switch and the egress ATM edge switch. The CSCS feature provides a mechanism to configure the service classes available for a particular customer, which may be set up through an individual CLP. As an example, CSCS may support the capability to configure various classes of service such as Continuous Bit Rate ("CBR"), Variable Bit Rate, Non-Real Time ("VBR-NRT"), Variable Bit Rate, Real Time ("VBR-RT"), Unspecified Bit Rate ("UBR"), and Available Bit Rate ("ABR"). The P2MR feature or service allows for point-to-multipoint VToA to be provided using an SVC. These types of connections are unidirectional and, just as with point-to-point connections, can support virtually any type of content such as voice or video.

Referring back to FIGURE 2, the ingress MSCP 108

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will provide any of a number of various features, such as those just described, by performing any of a number of database or table queries and executing any of a number of applications or algorithms. As a result, the ingress MSCP 108 provides an output back to the ingress ASIP 106 as represented by the line 126. This output will be used by the ingress ASIP 106 to generate an output ATM setup message. The output will normally include an ATM address of the called party CPE. The CPE may be implemented as, for example, an enterprise gateway, a network gateway, or virtually any other telephony access device. The ingress ASIP 106 assembles or generates the output ATM setup message and provides this message to the ingress ATM edge switch 104 as represented by a line 128 of FIGURE 2.

The output ATM setup message then passes through the ATM network 110 until it reaches the egress ATM edge switch 112. This is represented by a line 130. Similar to how the input ATM setup message was processed by the ingress devices, the egress devices process the output ATM setup message. Initially, the output ATM setup message is intercepted by the egress ASIP 114 once it reaches the egress ATM edge switch 112. This is represented by a line 132.

The egress ASIP 114 transfers various input values from the output ATM setup message to the egress MSCP 116. The egress MSCP 116 may provide various processing, but as mentioned above, most of the intelligent network service or feature processing will, preferably, be performed at the ingress side. The egress MSCP, in one embodiment, receives the ATM address of called party CPE and determines which port of the egress ATM edge switch 112 the setup message should be provided so that it may be communicated to the egress device 118. The egress MSCP 116, depending on the processing performed, may modify the input provided from the egress ASIP 114 and

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generate an output that is provided back to the egress ASIP 114, which is represented by a line 136 in FIGURE 2.

The egress MSCP 116 may provide various applications, logic, and the like to carry out any of a variety of advanced intelligent network features. The egress MSCP 116 may contain various data provided in tables or databases, or have the capability to access data external to the egress MSCP 116. It should also be noted that the features or services provided by the egress MSCP 116 and the ingress MSCP 108 may be achieved by the same MSCP. The ASIPs, however, will generally be associated or dedicated to each ATM edge switch that the ASIP serves. It should also be noted that although the egress MSCP 116 is shown in FIGURE 2 serving as an egress device 118, whenever the egress device 118 originates an SVC for VToA over the ATM network 110, the egress MSCP 116 will generally function as just described for the ingress MSCP 108.

The egress device 118, just as with the ingress device 102 described above, may be virtually any available CPE device such as, for example, an enterprise gateway, a network gateway, or a telephony access device. If the egress device 118 is an enterprise gateway, the egress MSCP 116 will generally not modify the input provided to it from the egress ASIP 114 and thus the egress ASIP 114 will receive an output from the egress MSCP 116 that is the same or similar as the input. In such a case, the output ATM setup message is provided to the egress ATM edge switch 112 where it is then provided to the egress device 118 to establish an SVC for VToA. This is represented by lines 138 and 140.

If the egress device 118 is a network gateway, or some similar device, the egress MSCP 116 may perform database operations to properly route the setup message to the egress device 118. In such a case, the egress

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MSCP 116 generates appropriate output and provides this output to the egress ASIP 114, as represented by the line 136. The egress ASIP 114 then assembles or generates another ATM setup message, which may be referred to as a destination or gateway ATM setup message, and provides this setup message to the egress ATM edge switch 112, which then provides such message to the egress device 118. This is represented by lines 138 and 140.

Once a party answers a telephony device, the egress device 118 generates an ATM connect message. This connect message is illustrated in FIGURE 2 by lines 142-162. The ATM connect message propagates through the ATM network 110 until a connection is made between the ingress device 102 and the egress device 118. The ATM connection message is processed, similar to the ATM setup message, such that the ingress and egress ASIPs and MSCPs intercept and analyze each such signaling messages. At this point, an SVC has been established between the ingress device 102 and the egress device 118 through the ATM network 110 to provide VToA with intelligent network services and features. The MSCP and the ASIP may also provide call modeling to track various calls.

Once a party desires to end the call, which can come from either the ingress device 102 or the egress device 118, an ATM release message is generated. In FIGURE 2, this ATM release message is generated by the ingress device 102. This proceeds similar to the connect and setup messages and is illustrated in FIGURE 2 by the lines 164-186. This ends the VToA call.

FIGURE 3 is a block diagram that illustrates an intelligent network 300 used at the ingress side of an ATM network for providing VToA services using an ATM switched virtual circuit. The intelligent network 300 includes an ASIP 302, an MSCP 304, and a service administration 306. A remote, external database 308 is

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also shown in FIGURE 3 with a communications link with the MSCP 304. The database 308 is provided to illustrate the fact that the MSCP 304 may rely on external databases or tables. The service administration 306 may also contain various tables or databases that the MSCP 304 accesses or that is provided to the MSCP 304 as a database of record.

The ASIP 302 interfaces with an ATM edge switch, not shown in FIGURE 3, and is capable of intercepting and receiving ATM message signals, such as ATM setup, connect, and release messages. When the ATM edge switch serves as the ingress ATM edge switch, the ASIP 302 receives ATM signaling messages from the device side of the ingress ATM edge switch. To establish an SVC to provide VToA, the ingress ATM edge switch provides an input ATM setup message from its device side to the ASIP 302. In addition to the functions described next, the ASIP 302 may also provide call modeling functionality. The ASIP 302 receives the input ATM setup message and, in one embodiment, extracts various information, such as the called party phone number value and the VToA designator, and communicates this information to the MSCP 304 as an input. The communications link between the MSCP 304 and the ASIP 302 may be a local connection or it may be a remote or long distance link. In one embodiment, the called party phone number value is stored in the called party subaddress parameter of the input ATM setup message and the VToA designator is stored in the called party number parameter of the input ATM setup message.

The MSCP 304, which also may be referred to as a policy server, includes various applications 310 and a database 312. The applications 310 may include any of a variety of software programs, logic, and algorithms that serve to provide VToA services and features. The database

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312 may include any of a variety of tables and information useful to provide VToA services and features.

The service administration 306 is capable of provisioning the MSCP 304, and in some embodiments, the ASIP 302. The service administration 306 may control or synchronize multiple MSCPs ensure that data or information in various MSCPs of the ATM network are coordinated and consistent.

The MSCP 304 receives the input from the ASIP 302 and can provide any number of VToA services and features. In order to establish an SVC for VToA, the MSCP 304 must determine if the input, provided by the ASIP 302 from the input ATM setup message, is a request to establish an SVC for VToA. If not, processing of an ATM data call proceeds. The MSCP 304, in a preferred embodiment, determines that the input ATM setup message is requesting an SVC to establish VToA by looking for the presence of the VToA designator. If present, the MSCP 304 uses the database 312 to determine the ATM address of the called party CPE using the called party phone number value provided as an input from the ASIP 302. The MSCP 304 may provide any of a variety of additional services and features, such as those described above in connection with FIGURE 2, and will, generally, use the applications 310 and the database 312 to achieve these services and features. The MSCP 304 generates an output in response to the processing just described and communicates this output to the ASIP 302. If a VToA is to be set up, the output will generally include at least the called party phone number value and the ATM address of the called party CPE.

To illustrate some of the processing that may be performed by the MSCP 304 on the input provided by the ASIP 302, the following examples are provided. Assuming that an ATM address of the calling party CPE is provided

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as part of the input ATM setup message, and preferably as the calling party number parameter, the ASIP 302 may provide this as an input to MSCP 304. The value of this address is then used to determine what services or features are available for this particular address. The MSCP 304 may also, by examining the value of the called party phone number value provided in the called party subaddress parameter of the input ATM setup message, determine or perform database queries to determine if the requested call is to a private number, a long distance or international number, a local number, an emergency number, etc. In a preferred embodiment, this is performed using various tables, which may be provided in the database 312, and by examination of the prefix digits of the called party phone number value. The MSCP 304 may also remove or add prefix or suffix digits to the called party phone number value. The result of any such prefix/suffix manipulation results in a revised called party phone number value. This revised number may then be used to determine a corresponding ATM address of the called party CPE.

The MSCP 304 may also, depending on the features and capabilities associated with one or more of the calling party phone number value, the ATM address of the calling party CPE, and the called party phone number value, consult a database or table of provisioned information to determine whether the called party phone number value should be translated to some other phone number and whether permission to make such a call is available. For example, the destination party may have forwarded their phone number to another phone number. In such a case, the MSCP 304 may determine that the called party phone number value should be translated to another called party phone number value. In such a case, the MSCP 304 may request whether the calling party has permission or

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sufficient rights to place a call to the translated or forwarded called party phone number.

As a result of the various manipulations and features and services provided by the MSCP 304, an output is provided to the ASIP 302. The ASIP 302 assembles or generates an output ATM setup message using the output from the MSCP 304. In a preferred embodiment, the resulting called party phone number value is stored in the called party subaddress parameter of the output ATM setup message, and the original calling party phone number value is stored in the calling party subaddress of the output ATM setup message. In addition, the output ATM setup message may include the ATM address of the calling party CPE stored in the calling party number parameter, and the calling party phone number value stored in the calling party subaddress. As an example, the following two tables illustrate various parameters and corresponding values or addresses of the input ATM setup message and the output ATM setup message.

INPUT ATM SETUP MESSAGE	
PARAMETERS	VALUE
Called Party Number	VToA designator
Called Party Subaddress	called party phone number value
Calling Party Number	ATM address of the calling party CPE
Calling Party Subaddress	calling party phone number value

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OUTPUT ATM SETUP MESSAGE	
PARAMETERS	VALUE
Called Party Number	ATM address of the called party CPE Called
Party Subaddress	called party phone number value
Calling Party Number	ATM address of the calling party CPE
Calling Party Subaddress	calling party phone number value

The ASIP 302 provides the output ATM setup message to the ATM network side of the ATM ingress edge switch where the output ATM setup message is provided to the ATM network and eventually delivered at the appropriate egress ATM edge switch to establish the SVC for VToA.

FIGURE 4 is a block diagram that illustrates the intelligent network 300 used at the egress side of the ATM network, such as the ATM network 18 of FIGURE 1, for providing VToA services and features using an ATM switched virtual circuit. Thus, in one embodiment of the present invention, the ASIP 302 and the MSCP 304 may provide intelligent network services and features to an ATM edge switch serving as an ingress ATM edge switch and an egress ATM edge switch, depending on how a VToA call is established.

When serving the associated ATM edge switch that is functioning as an egress switch, the intelligent network 300 receives the output ATM setup message from the ATM network. As mentioned above, the egress ATM edge switch may be considered part of the ATM network. The egress ATM edge switch provides the output ATM setup message to the ASIP 302.

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The ASIP 302 intercepts the output ATM setup message from the egress ATM edge switch and generates or extracts an input to provide to the MSCP 304. This input may include any of a variety of values provided by the output ATM setup message. For example, the input may include the ATM address of the called party CPE.

At the egress side, the MSCP determines the appropriate port or CLP of the egress ATM edge switch in which to route the ATM setup message. The MSCP 304, however, may provide any of a variety of services and features, and may provide additional routing information.

In the event that the MSCP 304 generates an output such that the ASIP 302 assembles or generates an ATM setup message that is different from the output ATM setup message, this new ATM setup message may be referred to as a destination or gateway ATM setup message. In any event, the ASIP 302 provides the ATM setup message to the device side of the egress ATM edge switch so that the ATM setup message may be provided to the appropriate CPE. Of course, the CPE may be provided as any number of devices such as an enterprise gateway, a network gateway, or various other telephony equipment. The CPE will generally interpret the ATM setup message by looking at the called party phone number value stored, preferably, in the called party subaddress parameter of the ATM setup message to determine how to make the final connection to the appropriate telephony device.

FIGURE 5 is a diagram, similar to **FIGURE 1**, that illustrates a telecommunications network 10 for providing point-to-multipoint services to control the setup of point-to-multipoint connections, according to an embodiment of the present invention. The telecommunications network 10 is shown to include all of the various ATM network elements of **FIGURE 1** with the addition of an ASIP 62, of the intelligent network 12,

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and an ATM edge switch 50. The ASIP 62 is in communication with the MSCP 46 and the ATM edge switch 50 to provide intelligent network services and features, such as to enforce policies regarding the setup of point-to-multipoint connections, through the ATM edge switch 50. The services administration 48 is shown in communication with the ASIP 62 to provide any needed provisioning, and possibly to provide a database of record.

The ASIP 62 is used in conjunction with the ATM edge switch 50 to intercept ATM signaling messages, such as an ATM setup message or an ATM add party message, and to extract and provide select information to the MSCP 46 for service and feature processing. The ASIP 62, the MSCP 46 and the service administration 48 operate to serve as the intelligent network layer of the ATM edge switch 50.

The ATM edge switch 50 is in communication with a CPE 60 to serve as the edge switch to the telecommunication network 10 to a telephony device 58 at the called party location 52. Thus, the ATM edge switch 50 is shown in FIGURE 5 serving as an ATM edge switch in relation to the called party location 52. The called party location 52, similar to the called party location 22 and the calling party 20, may be provided with any number of telephony devices.

A point-to-multipoint connection may carry any of a variety of contents such as voice, video, data, etc. If a point-to-multipoint connection is to be established from the calling party location 20 to one or more called party locations, such as the called party location 22 and the called party location 52, the calling party 20 would be considered or designated the root node and all other nodes would be referred to as leaf nodes, such as the called party location 22 and 52.

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In the present invention, the root node initiates all connections. Thus, an initial connection is made from the root node to a first leaf node. This initial connection of the point-to-multipoint connection is the same or similar to a standard point-to-point connection, which was described above in connection with FIGURE 1 for a point-to-point connection between the calling party location 20 and the called party location 22.

One difference, however, will involve the fact that the ATM setup message that is used to establish this initial connection of a point-to-multipoint connection will include a value or variable that indicates to each of the various ATM switches that this is the initial connection for a point-to-multipoint connection. Because of the flexibility and capability inherent in a point-to-multipoint connection, they are designed to be easily and efficiently expanded to include various other leaf connections. As such, each ATM switch may be provisioned to store certain information from the setup message provided with the initial connection of a point-to-multipoint connection so that future leaf connections can be more readily and efficiently established.

After a point-to-point connection is established between the calling party location 20 and, for example, the called party location 22 through the telecommunications network 10, a connection may be initiated from the root node, which in this case is the calling party location 20, to another leaf node, such as the called party location 52. In such a case, an ATM add party message is provided, and ultimately a connection is made with the called party location 52. The exact protocols and ATM functions that are used to establish each subsequent leaf node are known by one of ordinary skill in the art and are defined in the ATM

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specifications. These are discussed below in connection with FIGURE 6.

As mentioned previously, a point-to-multipoint connection is a unidirectional connection that proceeds from the root node or calling party location to the various leaf nodes or called party locations. Because the initial connection of a point-to-multipoint connection is from a root node to a first leaf node. An ATM setup message may be used to achieve this initial connection. The ATM setup message will, however, indicate that the setup is for a point-to-multipoint connection.

If the calling party location 20 initiates such an ATM setup message for a point-to-multipoint connection, the intelligent network 12 intercepts the message and analyzes the request from the calling party location 20 to establish a point-to-multipoint connection. In one embodiment, the intelligent network 12 determines if the calling party is authorized to make point-to-multipoint connection. This may be achieved, in a preferred embodiment, using the ASIP 40 to intercept the setup message and the MSCP 44 to perform point-to-multipoint service or feature processing. For example, the MSCP 44 may use a database or table to determine if the user or calling party is authorized to make point-to-multipoint connections. If not, the ATM setup request is rejected by the intelligent network 12.

The intelligent network 12, according to an aspect of the present invention, may also analyze the various bandwidth values that may be provided in such an ATM setup message for a point-to-multipoint connection. For example, the rate of the connection expressed in cells per second may be designated for a peak rate, a sustainable rate, and a burst size. Other bandwidth or capacity parameters could be provided.

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After the initial connection of a point-to-multipoint connection is established, subsequent requests involve root initiated attempts to establish another leaf node connection to expand the point-to-multipoint connection. This may be initiated using an ATM add party message. In such as case, the intelligent network 12 intercepts the ATM add party message and analyzes the message and, in association with the calling party's point-to-multipoint privileges or policies, determines, for example, if another leaf node may be added to the current point-to-multipoint connection. For example, if the maximum number of leaf nodes available to a particular calling party or customer would be exceeded by the addition of the requested leaf node, the request may be denied.

The present invention may also require that all subsequent leaf node connections to a point-to-multipoint connection pass the same feature test as the initial or first connection of the point-to-multipoint connection. For example, if the MSCP provides closed user groups, each subsequent leaf node connection may be subject to the same processing as the initial connection from the root node to the first leaf node.

FIGURE 6 is a line diagram, similar to **FIGURE 2**, that illustrates the signaling and call flow performed by the intelligent network to control and provide point-to-multipoint connectivity, according to an embodiment of the present invention. Generally, the initial connection between the root node and the first leaf node of the point-to-multipoint connection, which may be referred to as the initial connection, proceeds as described above in connection with **FIGURE 2**. One notable exception, however, is the fact that an input ATM setup message that is used to establish a point-to-multipoint connection provides a value that directs each ATM switch that it

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passes through that this is a request for a point-to-multipoint connection and that certain information of the setup switch should be retained or stored, so that future leafs of the point-to-multipoint connection maybe easily and efficiently connected.

FIGURE 6 includes a calling party device 102, which was referred to as an ingress device 102 in FIGURE 2, and a called party device 118, which was referred to as an egress device 118 in FIGURE 2. Generally, a point-to-multipoint connection is started in the upper left-hand portion at the calling party device 102 where an ATM setup message 120 is generated and communicated to an ingress switch 104. The ATM setup message 120 may be referred to as an input ATM setup message, that will include a request to establish a point-to-multipoint connection. Generally, the various ATM signaling provided from the ATM setup message 120 to the ATM connect message 162 is the same as that described in FIGURE 2 in connection with establishing a point-to-point connection through the various ATM signaling messages 120-162.

It should also be noted that the MSCP 108 will, preferably, provide the necessary point-to-multipoint services to provide such features as the capability to determine if a particular calling party is authorized to make a point-to-multipoint connection. Further, the MSCP 108 may analyze bandwidth request information from the ATM setup message 120 to determine if any bandwidth limitations will be violated.

Once the initial point-to-point connection is made from a root node to the first leaf node, additional connections may be established. Each additional connection will be initiated from the root node, which in FIGURE 6 is the calling party device 102, and will

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terminate at a leaf node, such as a called party node, if various conditions are met.

FIGURE 6 also includes a set of ATM devices that include a called party device 318, an MSCP 316, an egress ASIP 314, and an ingress switch 312. Of course, the egress switch 312, the egress ASIP 314 and the MSCP 316 provide various intelligent network functionality to the called party device 318. Assuming that the calling party device 102 desires to setup an additional connection to a leaf node, the calling party device 102 will initiate such a leaf connection. For example, if the calling party device 102 desires to establish an additional connection of the point-to-multipoint connection with the called party device 318, the root node generates an ATM add party message, such as the add party message 164 as shown.

In such a case, the MSCP 108 will receive the ATM add party message 168 and perform point-to-multipoint services. This may entail verifying that the maximum number of leaf nodes permitted in a point-to-multipoint connection has not been exceeded. The MSCP 108 can make such determinations since, in a preferred embodiment, it tracks all such connections and releases for the various point-to-multipoint connections. The maximum leaf node limit may be established based on any of a variety of factors such as the calling party profile, the customer profile, or a user group profile. Ultimately, the intelligent network will process the add party request and either reject or accept it. This is achieved by the intelligent network in a preferred embodiment by the MSCP 108.

The ATM add party message proceeds through the intelligent network, not unlike the setup message shown above, except that the add party message will in essence be a subset of the information provided by the ATM setup

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message 130. The ATM add party message passes through the ATM network 110, on its way to its ultimate leaf node destination, which may be the called party device 318, until it is provided at an ATM switch of the ATM network 110 that did not previously receive the ATM setup message 130 when the initial connection of the point-to-multipoint connection was being established. Thus, according to the "rules" of ATM, somewhere along the way the ATM add party message 174 is converted to an ATM setup message 176 so that all of the ATM switches involved in a point-to-multipoint. This message is received at an egress switch 312 where it is intercepted by the egress ASIP 314. The ATM setup message 178 proceeds through the egress switch 312, the egress ASIP 314, and the MSCP 316 until it is received at the called party device 318 as shown.

An ATM connect message is generated from the called party device 318 until, ultimately an ATM add party acknowledge message 198 is generated in the ATM network 110. Finally, an ATM add party acknowledge message 208 is provided to the calling party device 102 to complete this additional leaf connection.

During the pendency of the point-to-multipoint connection, information is provided in a unidirectional manner from the root node, such as the calling party device 102, to the various leaf nodes of the point-to-multipoint connection. Various leaf nodes may be added and dropped throughout the point-to-multipoint connection. Ultimately, the point-to-multipoint connection is terminated when the root node is dropped or released.

FIGURE 7 is a flowchart that illustrates a method 700 for providing a point-to-multipoint service to control point-to-multipoint connections using an intelligent network and a switched virtual circuit over

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an ATM network, according to another aspect of the present invention.

The method 700 begins at block 702 and proceeds to block 704 where an initial request is received from a calling party to establish a point-to-multipoint connection. Generally, block 704 through block 712 are performed during an initial request to set up a point-to-multipoint connection.

The method 700 proceeds next to block 706 where it is determined if the calling party is authorized to make point-to-multipoint connections. If it is determined at block 706 that the calling party is not authorized to make point-to-multipoint connections, the request is rejected at block 708. In a preferred embodiment, the determination of whether the calling party is authorized to make point-to-multipoint connections is performed by an MSCP. Generally, this will involve the use of a database or some other information source that provides relationship or associations between the calling party and various privileges. In one embodiment, the calling party is a member of a user group, and various privileges are assigned to the user group such that the calling party is bound by the privileges (or restrictions) associated with the user group.

The method 700 proceeds next to block 710 where the initial request is analyzed to determine if the bandwidth requested for the point-to-multipoint connection is within authorized bandwidth limits. If not, the request is rejected at block 712. In a preferred embodiment, the authorization of the calling party and the bandwidth request is only checked when an initial request to setup a point-to-multipoint connection is made. This is because there, in most cases, no need to inquire into these issues later when additional leaf nodes are being added because the authorization will generally not change

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and the bandwidth is not changed by additional leafs since the signals are replicated and split within the ATM network. A reference 713 is shown in FIGURE 7 to indicate, in a preferred embodiment, the transition from performing point-to-multipoint control on an initial request to performing point-to-multipoint control on subsequent add party requests to add additional leafs to the connection.

At block 714, and after at least the initial root node to leaf node connection has been established for a point-to-multipoint connection, a leaf request is received from the calling party to add a leaf node to the point-to-multipoint connection. In a preferred embodiment, this leaf request will be provided either directly or indirectly from an ATM add party message.

The leaf request is analyzed at block 716 to determine if some threshold or privilege has been violated. For example, if the maximum number of leaf nodes has been or would be exceeded by the addition of the requested leaf node, the leaf request is rejected at block 718. In a preferred embodiment, an MSCP at the ingress of the root node maintains a count of the number of current leafs provided in various point-to-multipoint connections. The method 700 ends at block 720.

As is illustrated by the method 700, the present invention provides significant control over point-to-multipoint connections which significantly improve the overall reliability and stability of an ATM network. It is also implemented in such a manner, such as at MSCP, that the various point-to-multipoint features or services may be easily configured or changed as needed. Such processing will preferably be performed at or in connection to an ingress ATM edge switch or ingress point of the ATM network.

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Thus, it is apparent that there has been provided, in accordance with the present invention, an intelligent network and method for providing VToA and point-to-multipoint connectivity that provides improved performance and that satisfies one or more of the advantages set forth above. The present invention provides advanced intelligent network services and features that dramatically increase the attractiveness of using VToA by providing the advanced services and features, with little administrative burden or expense to maintain. Although the preferred embodiment has been described in detail, it should be understood that various changes, substitutions, and alterations can be made herein without departing from the scope of the present invention, even if all of the advantages identified above are not present. For example, although the focus herein is primarily on VToA, however, application to other packet-switched telecommunications technologies, both individually and collectively, may apply also to any of the technologies mentioned above or similar technologies. Also, the techniques, systems, sub-systems, and methods described and illustrated in the preferred embodiment as discrete or separate may be combined or integrated with other systems, modules, techniques, or methods without departing from the scope of the present invention. For example, the ATM signaling intercept processor and the multi-service control point may be implemented separately or together, or may be directly coupled to each other or could be coupled through some other interface and are not considered directly coupled to each other but may still be in communication with one another. Other examples of changes, substitutions, and alterations are readily ascertainable by one skilled in the art and could be made without departing from the spirit and scope of the present invention.

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WHAT IS CLAIMED IS:

1. An intelligent network for use with an ATM network to set up an ATM switched virtual circuit to provide VToA services and point-to-multipoint connectivity, the intelligent network comprising:

5 a multi-service control point operable to receive an input extracted from an input ATM setup message that includes a called party phone number value, a VToA designator, and a request to establish a point-to-multipoint connection, enforce policies regarding the
10 establishment of point-to-multipoint connections, and generate an output in response for use in generating an output ATM setup message;

15 an ATM signaling intercept processor operable to intercept the input ATM setup message from an ingress ATM edge switch of the ATM network, extract the input from the input ATM setup message, communicate the input to the multi-service control point, receive the output generated by the multi-service control point, generate the output
20 ATM setup message using the output, and communicate the output ATM setup message to the ingress ATM edge switch of the ATM network; and

25 a service administration operable to provision the multi-service control point and the ATM signaling intercept processor.

2. The intelligent network of Claim 1, wherein the multi-service control point, in order to enforce policies regarding the establishment of point-to-multipoint connections, is operable to perform the following:

30 receive a request from a calling party to establish a point-to-multipoint connection,

determine if the calling party is authorized to make point-to-multipoint connections,

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reject the request if the calling party is not authorized to establish point-to-multipoint connections, analyze the request to determine if the bandwidth requested for the point-to-multipoint connection is within authorized bandwidth limits, and reject the request if the bandwidth requested is not within authorized bandwidth limits.

3. The intelligent network of Claim 1, wherein the multi-service control point, in order to enforce policies regarding the establishment of point-to-multipoint connections, is further operable to perform the following:

allow the point-to-multipoint connection to be established if the calling party is authorized to make point-to-multipoint connections and the bandwidth requested is within authorized bandwidth limits.

4. The intelligent network of Claim 1, wherein the multi-service control point, in order to enforce policies regarding the establishment of point-to-multipoint connections, is further operable to perform the following:

receive a leaf request from the calling party to add a leaf node to an existing point-to-multipoint connection,

analyze the leaf request to determine if the maximum number of leaf nodes has been exceeded, and

reject the leaf request if the maximum number of leaf nodes has been exceeded, but allow the existing point-to-multipoint connection to proceed without the requested leaf.

5. The intelligent network of Claim 1, wherein the called party phone number value is stored in the called

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party subaddress parameter of the input ATM setup message, the VToA designator is stored in the called party number parameter of the input ATM setup message.

5 6. The intelligent network of Claim 1, wherein the input ATM setup message is a request to setup a point-to-multipoint connection, and the input extracted from an input ATM setup message and provided to multi-service control point includes a bandwidth request value that
10 indicates the bandwidth requested for the point-to-multipoint connection.

15 7. The intelligent network of Claim 6, wherein the called party phone number value is stored in the called party subaddress parameter of the output ATM setup message, the ATM address of the called party is stored in the called party number parameter of the output ATM setup message, the calling party phone number value is stored
20 in the calling party subaddress parameter of the output ATM setup message, and the ATM address of the calling party CPE is stored in the calling party number parameter of the output ATM setup message.

25 8. The intelligent network of Claim 1, wherein the multi-service control point determines if the input ATM setup message requests an SVC for VToA by analyzing the VToA designator portion of the input.

30 9. The intelligent network of Claim 2, wherein the multi-service control point further includes:
a database that correlates point-to-multipoint authorization information with the calling party, and correlates the called party phone number value with an ATM address of the called party CPE, and wherein the

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multi-service control point includes the ATM address of the called party CPE in the output.

5 10. The intelligent network of Claim 1, wherein the multi-service control point is operable to track the number of leaf nodes of a point-to-multipoint connection.

10 11. The intelligent network of Claim 1, wherein the multi-service control point is operable to track the allocated bandwidth of a point-to-multipoint connection.

15 12. The intelligent network of Claim 1, wherein the multi-service control point is operable to track the number of leaf nodes of a point-to-multipoint connection, and to track the allocated bandwidth of a point-to-multipoint connection.

20 13. The intelligent network of Claim 1, wherein the content exchanged through a point-to-multipoint connection includes video.

25 14. A method for providing a point-to-multipoint service to control point-to-multipoint connections using an intelligent network and a switched virtual circuit over an ATM network, the method comprising:

receiving a request from a calling party to establish a point-to-multipoint connection;

determining if the calling party is authorized to make point-to-multipoint connections;

30 rejecting the request if the calling party is not authorized to establish point-to-multipoint connections;

analyzing the request to determine if the bandwidth requested for the point-to-multipoint connection is within authorized bandwidth limits; and

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rejecting the request if the bandwidth requested is not within authorized bandwidth limits.

5 15. The method of Claim 14, further comprising:
allowing the point-to-multipoint connection to be established if the calling party is authorized to make point-to-multipoint connections and the bandwidth requested is within authorized bandwidth limits.

10 16. The method of Claim 14, further comprising:
receiving a leaf request from the calling party to add a leaf node to the point-to-multipoint connection;
analyzing the leaf request to determine if the maximum number of leaf nodes would be exceeded if the
15 leaf request were granted; and
rejecting the leaf request if the maximum number of leaf nodes would be exceeded.

20 17. The method of Claim 16, wherein leaf request is provided as an ATM add party message.

18. The method of Claim 14, wherein the method uses a multi-service control point of the intelligent network.

25 19. The method of Claim 14, wherein the method is performed at an ingress of the ATM network.

30 20. The method of Claim 14, wherein the request is received from information generated from an input ATM setup message.

35 21. The method of Claim 14, wherein determining if the calling party is authorized to make point-to-multipoint connections is achieved using a profile associated with the calling party.

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22. The method of Claim 14, wherein determining if the calling party is authorized to make point-to-multipoint connections is achieved using a customer profile that is associated with the calling party.

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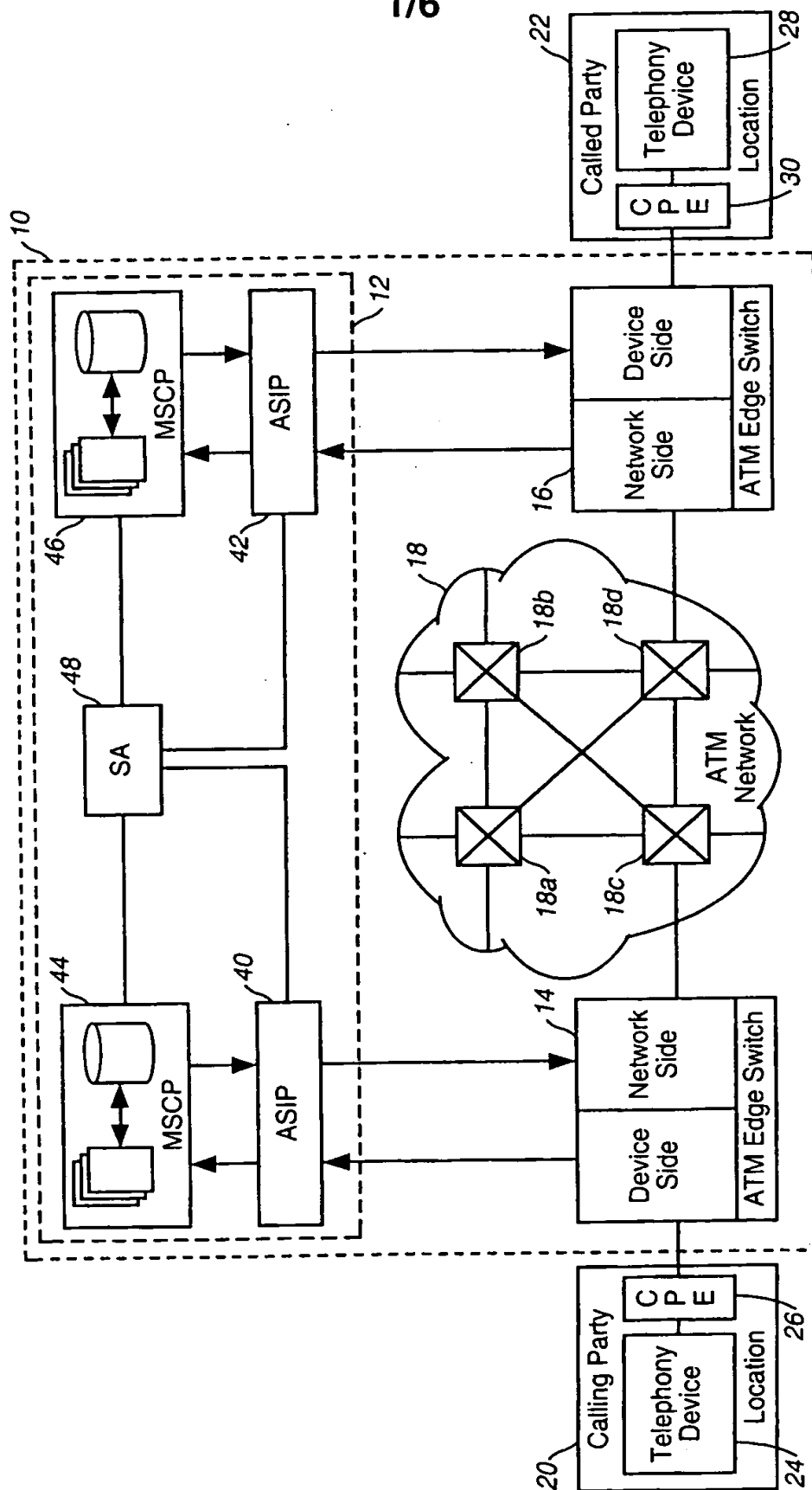


FIG. 1

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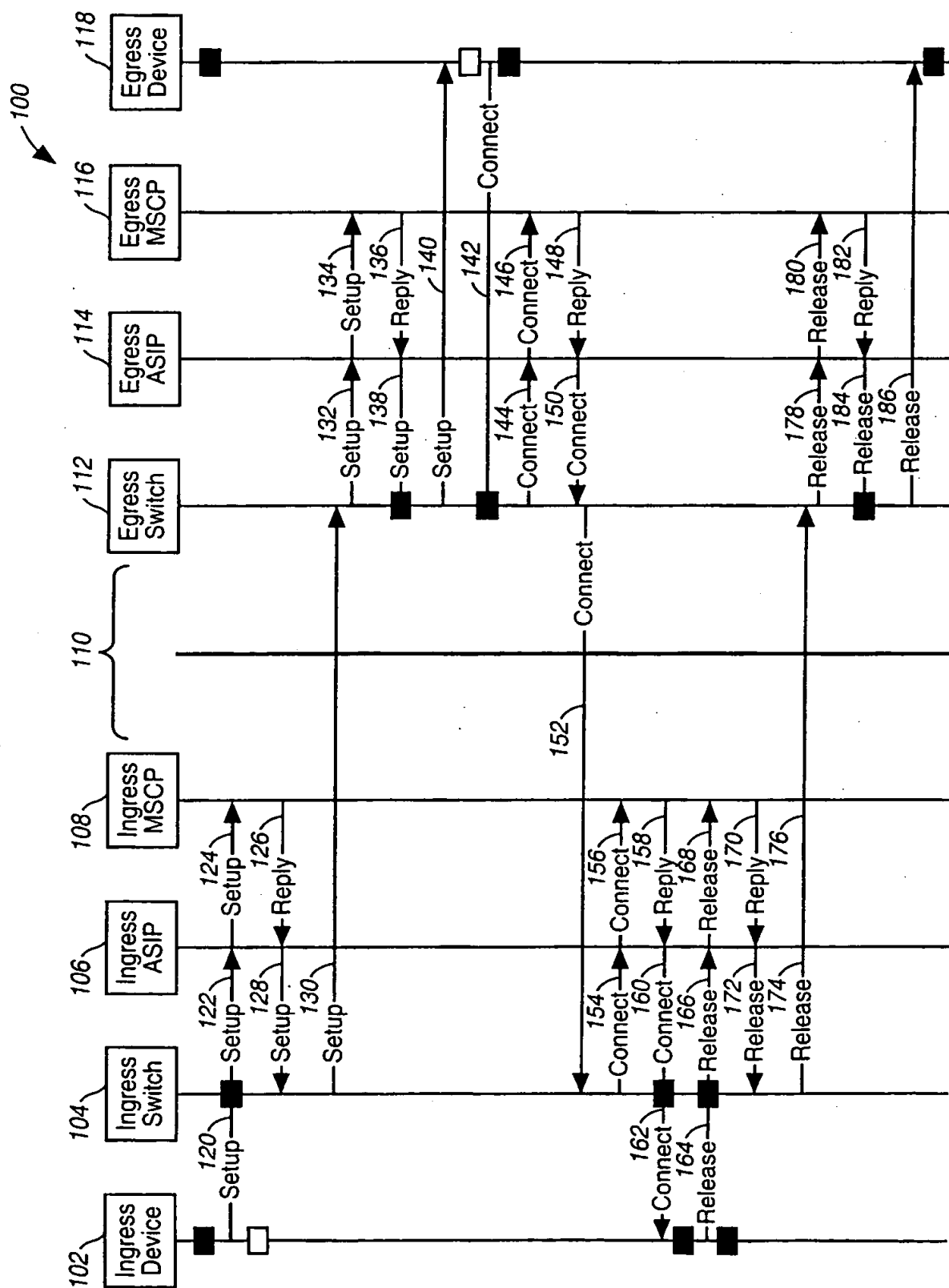


FIG. 2

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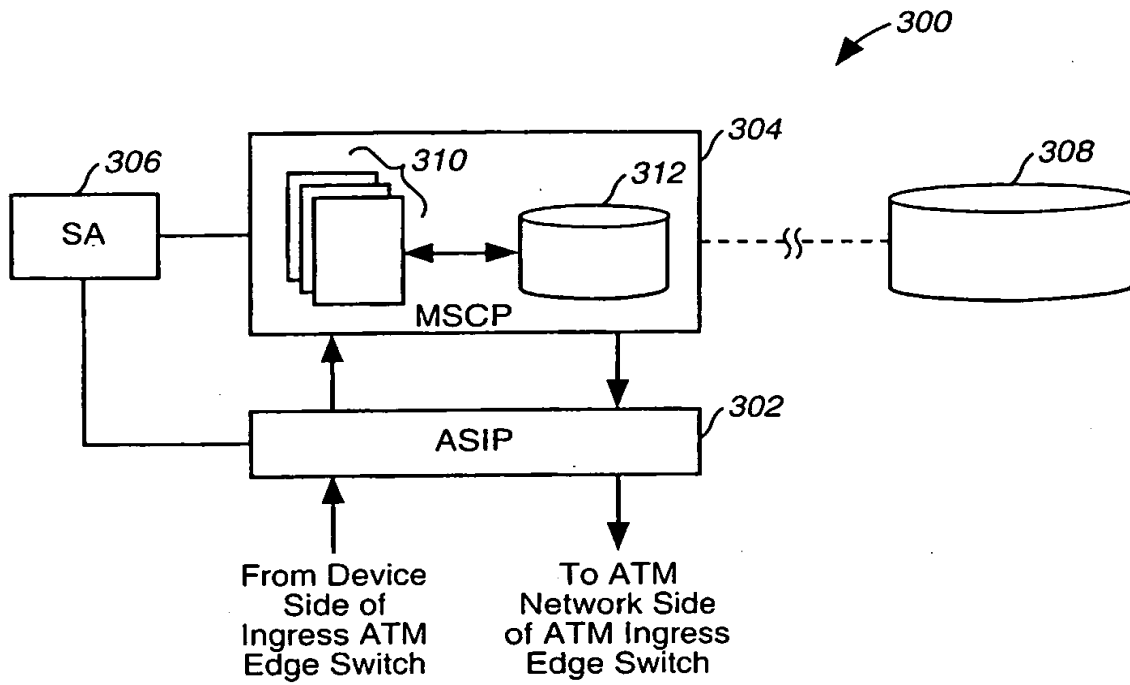


FIG. 3

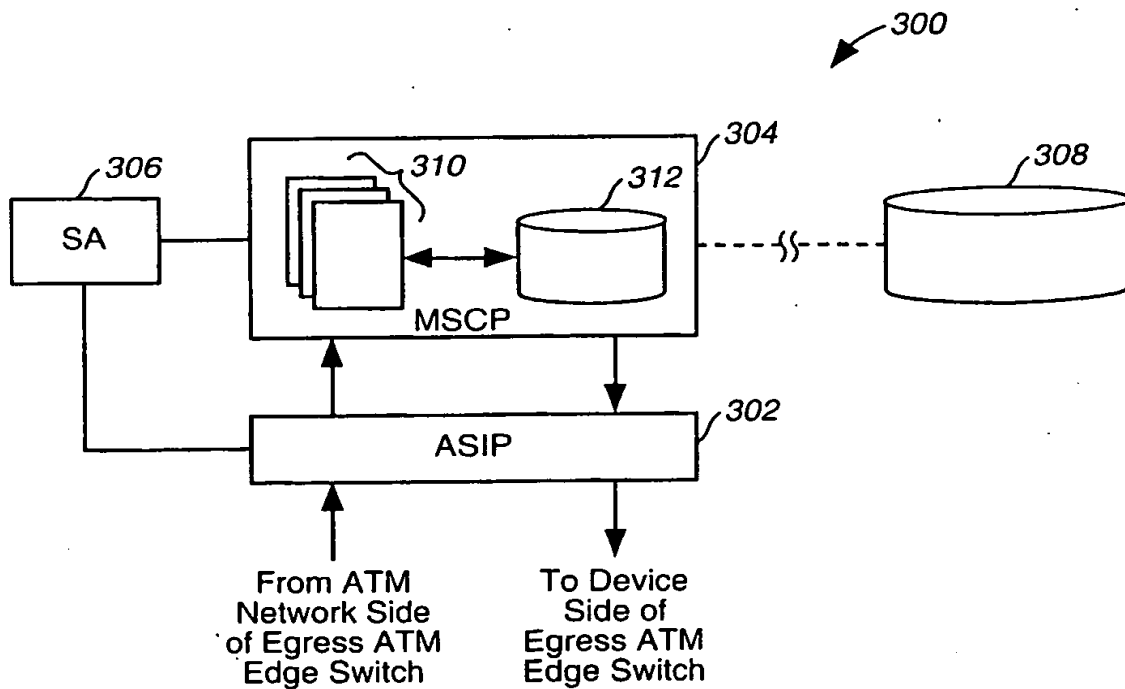


FIG. 4

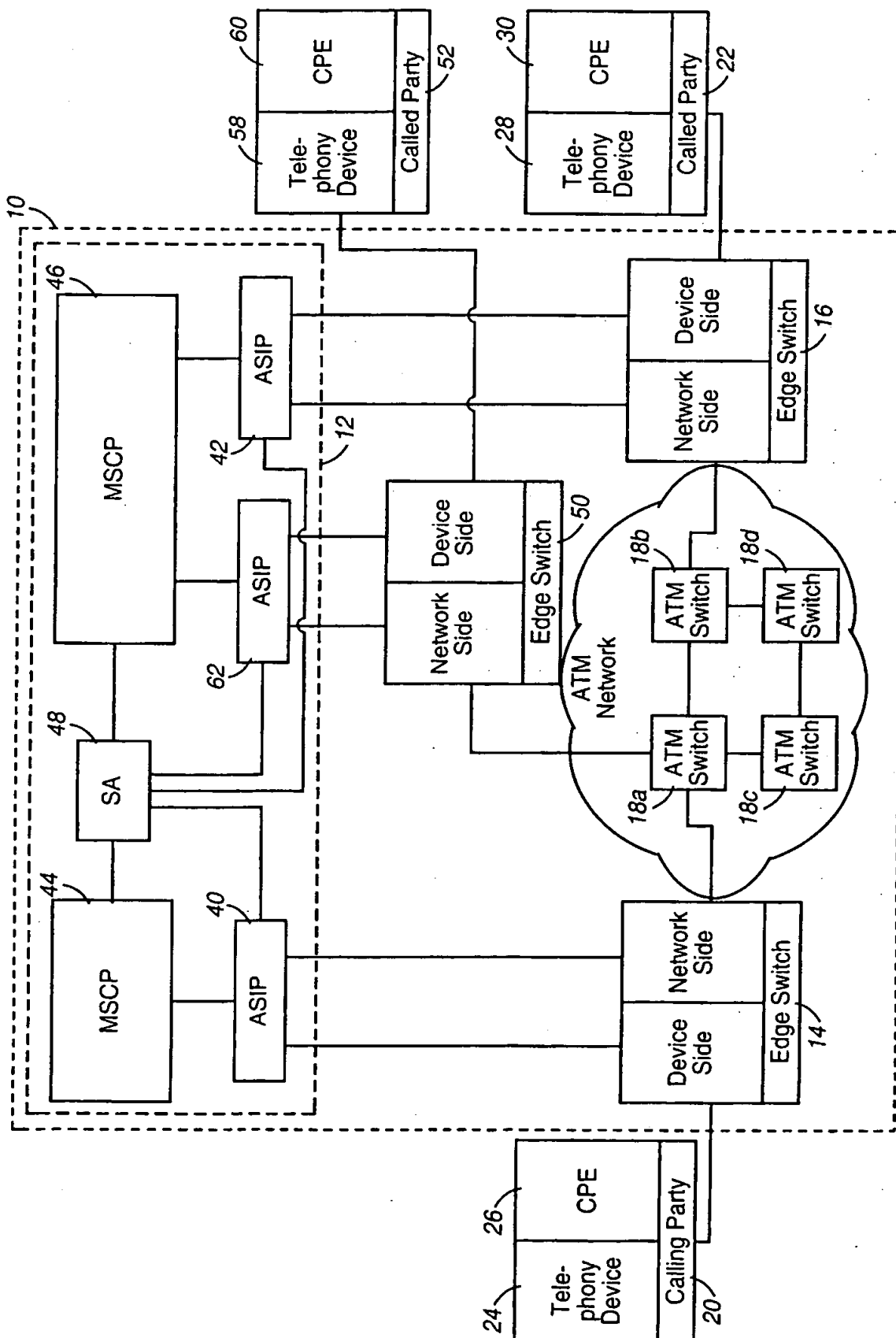
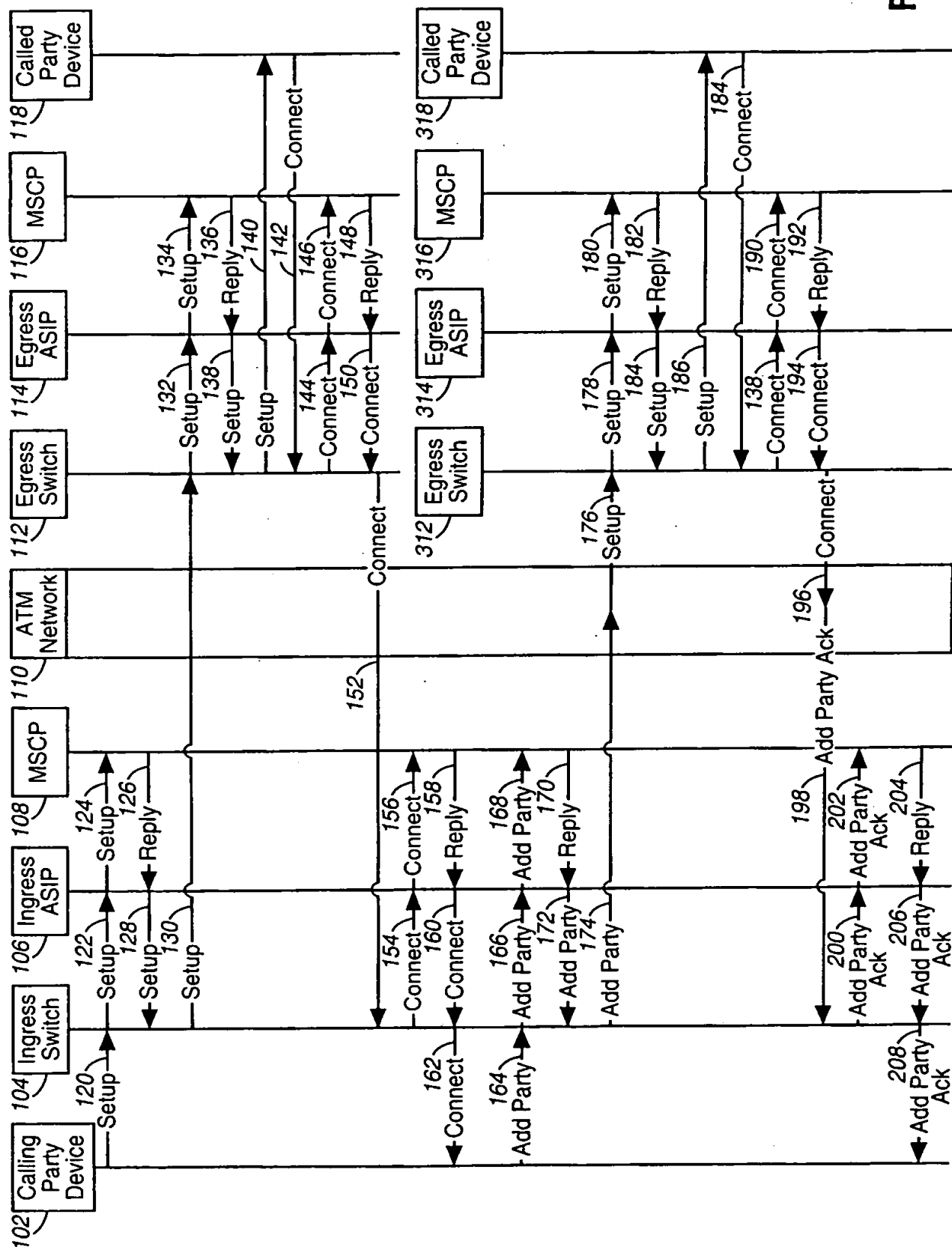


FIG. 5

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FIG. 6



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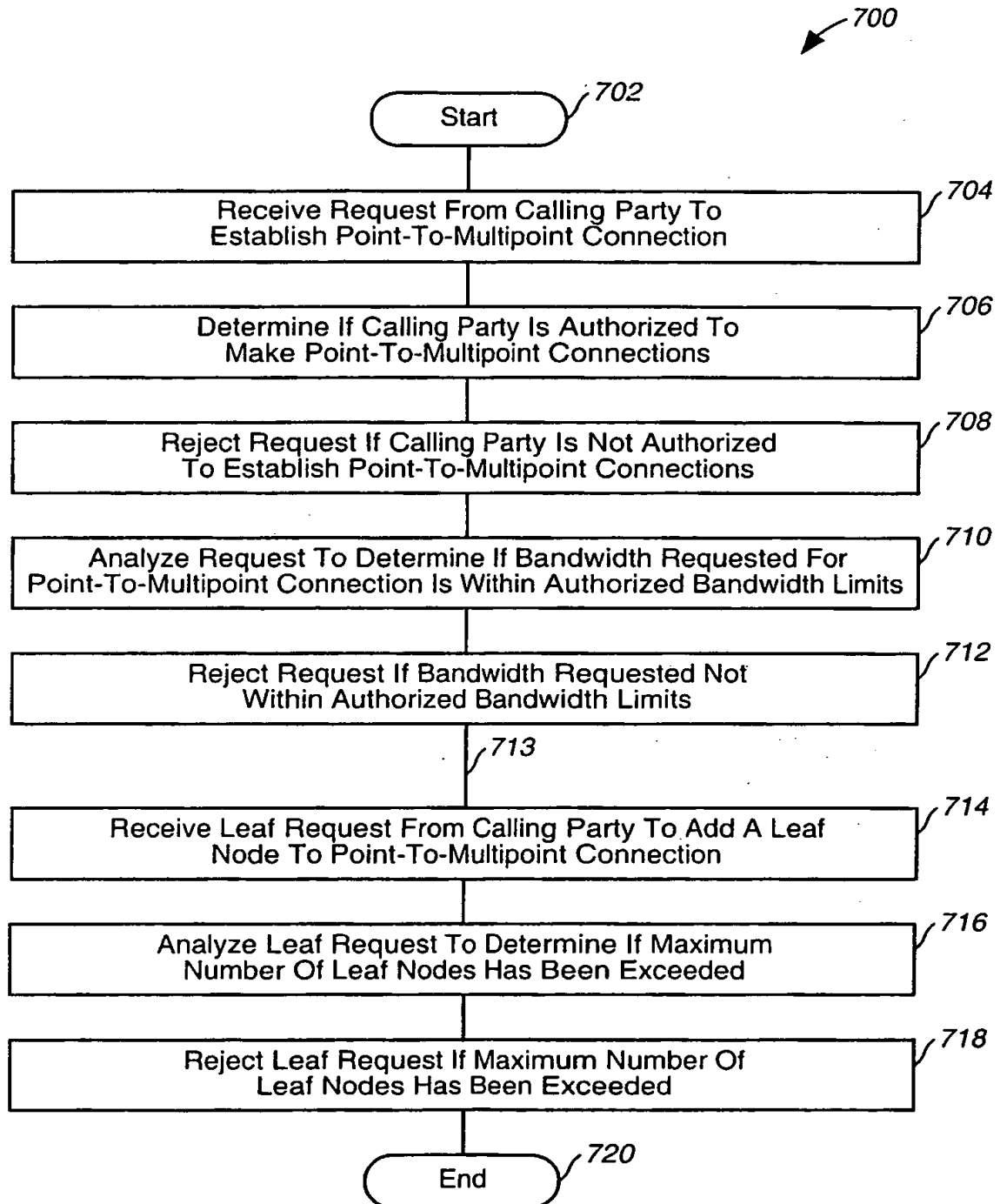


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/02205

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :HO4 L 12/28

US CL :370/410

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 370/410,390,395,522;379/201

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,473,679 A (La PORTA et al) 05 December 1995, see Fig. 2.	1-22
Y	US 5,825,780 A (CHRISTIE) 20 October 1998 See Figs. 2,6, and 7.	1-22
Y	US 6,009,099 A (LEWIS et al) 28 December 1999, See Fig. 1.	13
Y,E	US 6,185,219 B1(CHRISTIE) 06 February 2001, See FIGS, 2,6, AND 7 AND CLAIM 44.	1-22
A,E	US 6,169,735 B1 (ALLEN, JR. et al) 02 January 2001, See figs 4 and 5.	1-22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*G* document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means	
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

05 APRIL 2001

Date of mailing of the international search report

27 APR 2001

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Form PCT/ISA/210 (second sheet) (July 1998)*

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